
Florissant Fossil Beds

Lesson Plans

- Use with the **Florissant Fossil Beds** module.
- Use with the **Florissant** worksheets.
- Appropriate for grades **4** and higher.

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The Big Idea (or Central Theme)

What is the overall concept that we would like students to understand after exploring this module?

Earth's History

- Fossils provide important evidence of how life and environmental conditions have changed.

Populations and Ecosystems

- All populations living together and the physical factors with which they interact compose an ecosystem.

Essential Questions

What questions will encourage student inquiry?

- 1.** What is an ecosystem?
- 2.** Why would an ecosystem disappear?
- 3.** What evidence do scientists have that an ecosystem has disappeared?
- 4.** Why do scientists study fossils?
- 5.** Why is it important to learn about the earth's past?

Assessment

What evidence is there that students have achieved understanding of the Big Idea?

◆ **Performance Tasks / Projects**

1. Students will complete an Investigator's Report using the scientific method.
2. Students will create a visual representation of the Eocene ecosystem, including organisms living in the ecosystem, as well as physical factors with which they interact.

◆ **Quizzes / Tests**

1. Vocabulary quiz, if desired.

◆ **Prompts**

1. Students will keep a fossil notebook in which they illustrate and describe in writing some of the fossils they encounter.

◆ **Observation Data**

1. Observation data will be collected during class discussions and during work on the performance tasks and projects.

◆ **Self-assessments**

1. Students will self-assess their performance tasks, projects, and prompts.

Planning Lessons

Lessons should take teachers and students step-by-step through the modules. There will be several lessons per module.

Lesson One: Mysteries

Lesson Two: The Changing Ecosystem

Lesson Three: Fossils

Mysteries

Objectives

Students Will Be Able To use the scientific method to answer questions about fossils.

Objectives will vary depending on which mystery students work on:

- ◆ **Florissant's Past:** SWBAT draw conclusions about Florissant's past based on evidence.
- ◆ **Fossil Types:** SWBAT compare and contrast types of fossils. SWBAT explain how the formation process affects what type of fossil is formed.
- ◆ **Florissant's Wildlife:** SWBAT describe the current ecosystem of Florissant Fossil Beds National Park.
- ◆ **Ancient Climate:** SWBAT draw conclusions about the Eocene climate based on evidence.
- ◆ **Fossil Research:** SWBAT formulate hypotheses, gather evidence, and draw conclusions using fossils as evidence.
- ◆ **Research:** SWBAT summarize research that has been done at Florissant Fossil Beds National Park.
- ◆ **Fossil Origins:** SWBAT describe two processes of fossil formation.
- ◆ **Changing Climates:** SWBAT draw conclusions about how and why the climate has changed in the Florissant area from the Eocene to today, based on evidence.
- ◆ **Eocene Elevation:** SWBAT draw conclusions about whether or not the elevation at Florissant Fossil Beds National Park has changed since the Eocene, based on evidence.

Inquiry Questions

1. How is a scientist's question about the world similar to a mystery that might be solved by a detective?
2. What process does a scientist go through to answer a question or solve a mystery?
3. What questions might a scientist have about fossils?

Materials

- ◆ *Views of the National Parks* CD
- ◆ Printed Investigator's Reports

Procedure (Part One)

1. If students have not had a chance to explore the Views CD, allow them some time to explore on their own or in small groups.
2. After students have looked at the disc in general, ask them to find and explore the **Florissant Fossil Beds Module**. (At the Visitor Center, click on "Virtual Experiences," then on the "Florissant Fossil Beds" button). Encourage students to watch the short movie.
3. Direct students to the "Mysteries" section of the Florissant module. (On the Introduction page, you will see the word "Mysteries" in three different places. Click on any one of these.)
4. Students should click on "Next," and continue clicking on "Next," as they listen to the introduction to the Mysteries section. Students will know they are finished with the introduction when they come to the page titled "Available Cases."
5. Hints for working through the cases:
 - ◆ The Available Cases are divided into three leveled sections. Students can work their way through the cases from easier to more difficult, or can be assigned a case based on ability.
 - ◆ It might be helpful to work through one of the mysteries together before assigning individual students or small groups to work independently.
 - ◆ To begin a mystery, click on a case to open the case file. Read the observations.
 - ◆ Click on the "Ask" button. Students might have their own questions to add to the list.
 - ◆ Click on the "Plan" button. Read the information, then click on "Open Investigator's Report."
 - ◆ The Investigator's Report should be printed at this point. Students will fill the report out as they progress through the mystery.
 - ◆ The Investigator's Report has several sections:
 - Case Information – What do you already know about the topic?
 - Questions and Hypotheses – What does the scientist/detective want to find out? Students write the answers the questions on the Investigator's Report, forming their hypotheses.
 - Evidence – Where to look for the answers to the questions. Links are provided from the case file. Students write the applicable evidence on the Investigator's Report.
 - Results and Conclusions – Does the evidence gathered support the hypotheses? Students write their conclusions.
 - ◆ After printing the Investigator's Report, click on "Leads" to find the links that will provide the evidence needed to complete the Investigator's Report.
 - ◆ Next, click on "Reports" to find directions for completing the Investigator's Report.
 - ◆ The "Agency" button will link you to other Mysteries, if desired.

6. After students have had the opportunity to work through a Mystery, discuss the process. Ask: How is the work scientists do similar to the work detectives do? What evidence did you gather to support your hypothesis? What other scientific questions could be answered using this method? Could other types of questions be answered using this method? What did you learn about fossils?
7. If students did not all work on the same Mystery, allow some time for students to share their learning with each other.

Key Vocabulary

- ◆ Ecosystem
- ◆ Eocene
- ◆ Hypothesis
- ◆ Petrified
- ◆ Fossilized

Vocabulary will vary depending on which mystery students solve.

Discussion Questions

1. How is the work scientists do similar to the work detectives do?
2. What evidence did you gather to support your hypothesis?
3. What other scientific questions could be answered using this method?
4. Could other types of questions be answered using this method?
5. What did you learn about fossils?

Assessment

Students Will Be Assessed On ...

1. Participation in classroom discussion and other activities.
2. Completed Investigator's Report.

Differentiation

To best meet all students' needs, we suggest ...

1. If the Investigator's Reports are completed in groups, use heterogeneous grouping so that more advanced students can be of help to their teammates.
2. Providing sentence starters or fill in the blank sentences on the Investigator's Report.

The Changing Ecosystem

Objectives

Students Will Be Able To describe the Eocene ecosystem, including organisms living in the ecosystem, as well as physical factors with which they interact.

SWBAT describe how the ecosystem in this part of Colorado has changed over time, and why.

SWBAT explain how fossils were formed in the Florissant area.

Inquiry Questions

1. What evidence do scientists have that ecosystems have changed over time?
2. Why is it important for scientists to know what the land was like 35 million years ago?

Materials

- ◆ *Views of the National Parks* CD
- ◆ Two Column Notes worksheet
- ◆ Self-Assessment Questions
- ◆ Florissant Series of Events Chain worksheet



Procedure (Part One - The Eocene Ecosystem)

1. Direct students to the “Tours” section of the Florissant module. (On the Introduction page, you will see the word “Tours” in three different places. Click on any one of these.)
2. Guide the class to the tour of “The Eocene Epoch.” Ask students to click on the five different sections of the illustration of “Eocene Ecosystems,” (Lake Environment, Sequoia Forest, Between Tours and Pools, Grasslands, and Slopes of the Volcanic Complex.) Students should take notes using the [Two Column Notes](#) handout as they explore. The sections listed above are the “Main Ideas.”
3. Project: Based on their notes, ask small groups of students to create a visual representation of the Eocene ecosystem, including organisms living in the ecosystem, as well as physical factors with which they interact. Brainstorm what this might look like (examples could include a poster, diorama, a map, or a dramatic representation.) Encourage students to be as creative as possible.
4. After projects have been created, allow students an opportunity to share their work. Encourage students to self-assess their work using the [Self-assessment Questions](#).

Procedure (Part Two - Formation of Fossils)

1. From the “Eocene Epoch” page, direct students to click on the first box (Eocene: Volcanic Activity.) Continue to click on the first box on each page. This will take you through eight pages, which describe how the Florissant fossils were formed.
2. Complete the [Florissant Series of Events Chain](#) worksheet. Depending on age and/or ability, ask students to write a sentence or draw a picture that illustrates what happened at each step of fossil formation.

Procedure (Part Three - Recent Times Ecosystem)

1. Guide the class to the tour of “Recent Times.” There is quite a bit of information here. Allow students some time to freely explore.
2. Direct students to the “Present Day Ecosystem” link. Ask them to spend some time exploring the Naturalist Notes, looking for similarities and differences between “Recent Times” and “The Eocene Epoch.”
3. Numbered Heads Together: Divide students into groups of four, assigning students the numbers 1 through 4 within each group.
4. You will ask the groups a series of questions. After each question the groups should put their heads together, hold a whispered discussion about the question, and make sure each member of the group is ready to share an answer if called upon.
5. After groups have had a bit of time to discuss each question, randomly call a number (1 through 4.) Each student with that number should stand up. Call on these students to share the results of their group’s discussion.

6. Sample Questions:

- ◆ What plants were evident in the Eocene Epoch?
- ◆ What plants live in this area during recent times?
- ◆ Why do you think these plants are so different?
- ◆ What animals were evident during the Eocene Epoch?
- ◆ What animals live in this area during recent times?
- ◆ Why do you think these animals are so different?
- ◆ Based on what you have learned, why has the ecosystem in this area changed so much over the years?
- ◆ Based on what you have learned, how do scientists know this ecosystem has changed?
- ◆ Do you think the ecosystem will continue to change? Why or why not?
- ◆ How do you think it might change?

Key Vocabulary

◆ Permineralization

◆ Lahar

◆ Pumice

◆ Gradient

◆ Montane

◆ Pollinators

Discussion Questions

1. What was the ecosystem like during the Eocene Epoch?
2. What evidence did scientists use to determine this?
3. Why is it important to know how ecosystems have changed over the years?
4. What can scientists learn from studying fossils?
5. How were the fossils of the Florissant area formed?
6. How do scientists know how these fossils were formed? What evidence do they have?



Assessment

Students Will Be Assessed On ...

1. Participation in classroom discussion and other activities.
2. Completed Two Column Notes worksheet.
3. Completed Florissant Series of Events Chain.
4. Completed Visual Representation of the Eocene Epoch, including self assessment.

Differentiation

To best meet all students' needs, we suggest ...

1. Heterogeneous grouping for the Visual Representation project and Numbered Heads Together so that more advanced students can be of help to their teammates.
2. Providing sentence starters or fill in the blank sentences on the Two Column Notes and Florissant Series of Events Chain worksheets.

Fossils

Objectives

Students Will Be Able To describe the process used to find and identify fossils.

SWBAT identify fossils found at Florissant.

SWBAT use appropriate vocabulary when describing fossils.

Inquiry Questions

1. What different kinds of fossils can be found at Florissant?
2. How do scientists find the fossils?
3. How do scientists identify the fossils?

Materials

- ◆ *Views of the National Parks* CD
- ◆ Fossil Notebook
- ◆ Plaster of Paris
- ◆ Sawdust or dirt
- ◆ 1 small paper cup per student
- ◆ 1 small chicken bone or shell per student
- ◆ construction paper
- ◆ bamboo skewers or craft sticks
- ◆ small paintbrushes

Procedure (Part One - Identifying Fossils)

1. Direct students to the “Tours” section of the Florissant module. (On the Introduction page, you will see the word “Tours” in three different places. Click on any one of these.)
2. Guide the class to the tour of “Recent Times.” From this page, click on “Fossils.”
3. Next, click on “Collection Book.” There are two collections of fossils: Plants and Insects. Encourage students to explore in these collection books for a time.
4. Click on the “Plant Identification Book.” Then click on the tab called “Terms.” Students should begin filling out the first page of the **Fossil Notebook** using the information contained here. Students will also need to access the “Terms” located in the “Insect Identification Book” in order to complete the first page of their Fossil Notebooks.
5. Students should click on the “Plant” and “Insect” tabs to locate the information needed to complete the second and third pages of the Fossil Notebook.

Procedure (Part Two - Virtual Fossil Discovery)

1. A day or two before beginning this lesson, prepare “fossils” for students to excavate:
 - a. Mix the Plaster of Paris with the dirt or sawdust until the consistency is almost as thick as mashed potatoes.
 - b. Pour this mixture into the paper cups until it covers the bottom of the cup. (One cup per student.)
 - c. Drop in the chicken bone or shell and cover with more of the plaster mixture.
 - d. Allow to dry for a day or two, then remove the paper cups.
2. From the Fossils of Florissant Valley page, click on “Virtual Fossil Discovery.” This is a self-directed activity that students can work through at their own pace.
3. Give each student one of the previously prepared hidden “fossils.”
4. Use the construction paper as a workspace.
5. Using the bamboo skewers or craft sticks as picks, students should pick away at the plaster to reveal the embedded fossils, taking care not to damage the fossils.
6. The paintbrushes can be used to remove smaller particles of plaster from the fossils.
7. Students should describe and illustrate their fossil on the last page of their Fossil Notebooks.
8. Discuss the process. Ask: What did you enjoy about the process of “digging out” your fossil? Was there anything you did not enjoy? What qualities should a paleontologist have in order to be successful at finding and excavating fossils? Can anyone look for fossils at Florissant? Why or why not?

Lesson Three

Key Vocabulary

- ◆ Paleontology
- ◆ Excavation
- ◆ Stratigraphic Column
- ◆ Biodegradable

Discussion Questions

1. What did you enjoy about the process of “digging out” your fossil?
2. Was there anything you did not enjoy?
3. What qualities should a paleontologist have in order to be successful at finding and excavating fossils?
4. Can anyone look for fossils at Florissant? Why or why not?

Fossil Discovery

Assessment

Students Will Be Asessed On ...

- 1.** Completed Fossil Notebooks.
- 2.** Participation in classroom discussion and other activities.

Differentiation

To best meet all students' needs, we suggest ...

- 1.** Pairing students who might need assistance with an appropriate partner for the Fossil Discovery activities.
- 2.** Providing sentence starters or fill in the blank sentences on the Fossil Notebook.